



Verification Report

City of Cambridge 2016 GHG Emissions Inventory

Prepared for:

City of Cambridge

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1.0 Introduction

Ruby Canyon Engineering (RCE) was contracted by the City of Cambridge (City) to perform the third-party greenhouse gas (GHG) emissions inventories verifications for the City's facilities reporting under operational control to the ISO 14064 standard and the requirements of The Climate Registry's (TCR) reporting program for 2016. The City is not reporting to TCR for 2016; however, the inventory is being verified against TCR's program requirements.

1.1 Inventory Description

The City of Cambridge's 2016 emissions inventory covers emissions from all City facilities and includes emissions from stationary combustion, emissions from mobile combustion, fugitive emissions, and emissions from purchased electricity. Emissions of all six Kyoto Protocol gases plus nitrogen trifluoride (NF₃) are included; however, the entity has no PFC, SF₆ or NF₃ emissions.

1.2 Responsible Party

City of Cambridge
344 Broadway
Cambridge, MA 02144

1.3 Verification Team

The RCE verification team consisted of the following individuals who were selected based upon verification experience and knowledge of general reporting of GHG emissions sources and local government operations.

Lead Verifier: Nina Pinette

Independent Peer Reviewer: Jessica Stavole-Carter

1.4 Objectives

The objective of the verification activities was to ensure that the reported GHG emissions are complete, transparent, verifiable, and estimated and reported according to TCR's reporting protocols. Furthermore, the verification activities ensure that the data provided to RCE is well documented and free of any material errors or omissions.

1.5 Scope

The scope of the verification consisted of the following independent and objective activities:

- Review the 2016 GHG emission sources;
- Review the 2016 inventory support documents;
- Review the organizational and operational boundaries;
- Conduct a site visit to selected City facilities;
- Review the inventory data acquisition and quality control procedures;
- Review the GHG emissions calculations;
- Review the documents and data against the Verification Criteria listed in Table 1;
- Issue requests for corrective actions, additional documentation, and clarifications as necessary; and
- Issue a Verification Report and List of Findings to the City of Cambridge.

1.6 Verification Criteria

Table 1. Verification Criteria

Criteria	Details
Standards and Protocols for Verification	<ul style="list-style-type: none"> • The Climate Registry’s General Reporting Protocol (GRP) Version 2.1 (January 2016) • The Climate Registry’s GRP Updates and Clarifications document (March 2018) • The Climate Registry’s General Verification Protocol (GVP) Version 2.1 (June 2014) • The Climate Registry’s GVP Updates and Clarifications document (March 2016) • ISO 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions
Reporting Years	2016
Reporting Basis	Full – North America
Level of Assurance	Reasonable assurance
Materiality	A +/-5% materiality threshold, assessed separately for Scope 1, Scope 2 location-based, and Scope 2 market-based emissions

2.0 Verification Activities Summary

As the first step in verification activities, RCE developed a verification plan to follow throughout the verification process. The verification plan included the following activities:

- RCE completed an internal Conflict of Interest Assessment Form to identify any potential conflicts of interest with the City. The COI assessment revealed no conflicts of interest.
- RCE held a verification kickoff meeting with the City on February 22, 2018. During the kickoff meeting, RCE reviewed the verification objectives, verification process, and the verification schedule.
- RCE performed a strategic review and risk assessment of the received data and support documents in order to understand the scope and areas of potential risk in the GHG emissions inventories.
- RCE developed risk-based sampling plans based upon the strategic review and risk assessment. The verification team used the verification plan and sampling plan throughout the verification, and they were revised as needed based upon additional risk assessments.
- RCE conducted a site visit on April 3, 2018. During the site visit RCE performed key personnel interviews; inspected GHG emission sources; observed the onsite data management systems; and reviewed data gathering, monitoring, and handling procedures.
- RCE performed a risk-based desktop review of the submitted verification documents. The review included an assessment of the GHG emissions calculation methods and inputs, source data completeness, GHG data management and monitoring systems, and company record retention practices.

- RCE submitted requests for corrective actions, additional documentation, and clarifications as necessary throughout the verification.
- RCE’s independent peer reviewer conducted a review of the verification sampling and verification report.
- RCE issued a final Verification Report and List of Findings.
- RCE held an exit meeting with the City on June 29, 2018.

3.0 Verification Findings

3.1 Assessment of the GHG Emission Sources

Prior to the site visit, the verification team reviewed the City’s inventory calculation spreadsheets. Based on the information in the spreadsheets, the verification team developed a sampling plan for the site visit. The sampling plan was based on the relative magnitude of emissions from each category as well as the relative magnitude of emissions from individual sources. The relative magnitude of emissions from each City department is shown in Table 2 below.

Table 2. Emissions from City of Cambridge Departments

Departments	2016 Scope 1 Emissions (tCO ₂ e)	% 2016 Scope 1 Emissions	2016 Scope 2 Emissions* (tCO ₂ e)	% 2016 Scope 2 Emissions	2016 Scope 1 Biogenic Emissions (tCO ₂ e)
Buildings & Other Facilities	5,734.51	65.3%	8,073.64	73.3%	-
Vehicle Fleet	2,594.01	29.6%	-	-	116.18
Water Delivery	449.08	5.1%	2,217.45	20.1%	-
Street Lights/Traffic Signals	0.30	0.0%	707.59	6.4%	-
Wastewater	-	-	17.65	0.2%	-
Scope 1 Total	8,777.90		11,016.33		116.18

Individual sources may not sum to total; table is for summary purposes only

**The City’s Scope 2 location-based and Scope 2 market-based emissions are equivalent and reported under Scope 2 emissions in this table*

RCE conducted the site visit on April 3, 2018. The lead verifier visited the Department of Public Works Ryan Garage, the War Memorial Recreation Center, and the Cambridge Public Library. The Department of Public works maintains and manages City vehicles at the Ryan Garage. Here, RCE viewed a vehicle fueling station and reviewed the Fuel Master program. RCE also viewed a sample of vehicles owned by the City including rubbish trucks, police vehicles, pickup trucks, and snow equipment. RCE also visited two facilities under the buildings and other facilities department, the War Memorial Recreation Center and the Cambridge Public Library, since the department represents 65 percent of Scope 1 emissions and 73 percent of Scope 2 emissions. At these facilities, RCE viewed natural gas boilers and water heaters and diesel emergency generators.

During the visit, the lead verifier met with and interviewed the City’s Sustainability Planner who is responsible for the development of the GHG assertion which was provided to the verification team prior to the visit. RCE also met with the City’s Energy and Sustainability Analyst who manages the Mass Energy Insight (MEI) database (discussed in more detail below). The lead verifier discussed source data used in the development of the GHG emissions inventories which consists of database extracts and fuel invoices.

3.2 Assessment of the GHG Emissions Data Management System

During the site visit, RCE interviewed the key personnel who developed the GHG inventories. RCE reviewed the City's procedures for data collection, data handling, and data QA/QC as well as record retention and backup procedures. RCE confirmed that these procedures were rigorous, that there are redundant procedures in place to ensure that data will be backed up in multiple locations, and that in the event that any data used as an input to calculate emissions is lost, it can be recovered.

The City uses Mass Energy Insight (MEI) to track all municipal fuel use data, including electricity. MEI is a state-level online software which tracks utility data. Utilities upload data into the system. RCE also compared invoices to MEI data for some accounts as discussed below.

3.3 Assessment of the GHG Emissions Calculations

RCE's emissions calculations assessment included a review of the data inputs into the City's inventory calculation spreadsheets, calculation of the input values, and accuracy of the emission factors and calculation methodologies selected for each emissions source. RCE evaluated the completeness and validity of the original data and how the data was transferred to the inventory calculation spreadsheets.

During the desktop review, RCE conducted cross checks of spreadsheet functionality and compared calculation methodologies in the spreadsheets to the methods described by key personnel onsite during the site visit and to TCR's General Reporting Protocol methodologies. RCE found that the GHG calculations were accurate and consistent with TCR's methodologies.

3.3.1 Scope 1

RCE reviewed the calculation of stationary combustion emissions from natural gas combustion at City facilities for 2016 which represents approximately 57 percent of total Scope 1 emissions. Natural gas is combusted in boilers, heaters, hot water heaters, and cafeteria kitchens. RCE also reviewed the calculation of stationary combustion emissions from oil which represent approximately 9 percent of total Scope 1 emissions. RCE reviewed the sums of monthly fuel quantities by account in MEI and compared invoices for natural gas for some accounts to the monthly quantities in MEI. RCE also confirmed that appropriate emission factors were applied to the fuel quantities to calculate emissions. RCE identified some small errors in the emissions calculations due to not prorating for the 366 days in CY2016 and/or instances where an additional month was included in the annual total. When combined, these discrepancies due to not prorating and including extra invoices in annual consumption were non-material.

Mobile emissions accounted for approximately 27 percent of Scope 1 emissions in 2016. Again, the City utilizes MEI to track gasoline and diesel fuel for mobile sources. The City tracks fuel dispensed using its Fuel Master program and inputs consumption data to MEI. RCE used Fuel Master records for dispensed fuel as a check on fuel purchases input to MEI as well as the records for fuel deliveries to City fuel tanks and monthly inventories. The totals for both gasoline and diesel were similar among the three methods to track fuel. RCE also reviewed the selection and application of CO₂ emission factors for gasoline and diesel in the emissions calculations and reviewed the City's use of TCR's Simplified Estimation Method (SEM) to calculate CH₄ and N₂O emissions using the factors in Table 13.9 for metric tons of GHG per metric ton of CO₂.

RCE reviewed methods to track refrigerant recharge. For 2016, service records were not available, and the City reported emissions based on 2015 records. RCE confirmed this is an appropriate simplified estimation method (SEM) to calculate fugitive emissions. RCE also verified that the sum of emissions

calculated using this SEM and the mobile combustion emissions calculated using a SEM is 3.2 percent and thus below the 5 percent of total emissions threshold set by TCR.

Emissions from combustion of diesel and natural gas by emergency generators are not reported completely, but this represents a non-material difference in the final emissions totals. The natural gas combusted by emergency generators is captured under building natural gas use. The diesel combusted by the Department of Public works emergency generators is captured under fuel use by vehicles. There was a small quantity of diesel combusted by emergency generators in 2016 that was not included in the inventory.

RCE confirmed that the City's reported Scope 1 emissions are materially correct.

3.3.2 Scope 2

RCE reviewed the calculation of emissions from purchased electricity for the City using both the location-based and market-based methods. The City does not have any specified electricity purchases and does not purchase electricity from any utilities with utility specific factors and thus the location-based and market-based totals are equivalent.

Again, the City utilizes MEI to track purchased electricity. RCE reviewed the sums of monthly electricity consumption by account in MEI and compared electric invoices for some accounts to the monthly quantities in MEI. Like with natural gas, there were calculation discrepancies for some accounts which did not include the full 366 calendar days and/or were not prorated for CY2016. These discrepancies were non-material.

RCE also confirmed that appropriate emission factors were applied to the quantities to calculate emissions. The City used ISO New England Inc. CO₂ emission rates for New England for 2016. These factors are third-party developed geographic emission factors, are publicly documented, and have been through a review process. RCE confirmed that the use of these factors was reasonable and met TCR's requirements for third-party developed emission factors. The City used eGRID factors to calculate CH₄ and N₂O emissions from purchased electricity.

RCE confirmed that the City's reported Scope 2 emissions are materially correct.

3.3.3 Prior Year Comparison

The most recent emissions inventory verified was 2012. RCE compared 2016 emissions to 2012 emissions. Scope 1 emissions did not change much and decreased 3 percent from 2012 to 2016. Scope 2 emissions decreased 15 percent from 2012 to 2016. This is primarily due to a decrease in electricity consumption by street and traffic lights. Since 2012, the City installed LED streetlights. Additionally, the City used a flat rate method to calculate electricity use for all streetlights in 2012 and had actual consumption data for some in 2016 and thus the method for 2016 is more accurate.

4.0 Verification Results

The City provided sufficient evidence and documentation of its emissions calculations, data collection procedures, and monitoring and quality control procedures for its facilities and emission sources. The verification process focused on verifying the emissions calculations and the source data used by the City to quantify its GHG emissions in accordance with TCR's General Reporting Protocol. Table 3 defines the GHG emissions verified for 2016.

During the verification process, RCE made requests for corrective actions, additional documentation, and clarifications to complete the verification. The City sufficiently addressed all material corrective action requests. The details of these requests are documented in RCE's List of Findings provided to the City.

5.0 Conclusion

RCE conducted a risk-based analysis of the City's GHG emissions inventories and a strategic review of the inventory data and calculations. Based upon the processes and procedures and the evidence collected, RCE concludes that the GHG assertions are a fair representation of the GHG emissions for 2016 and can be considered:

- In conformance with The Climate Registry's General Reporting Protocol Version 2.1,
- Without material discrepancy in Scope 1, Scope 2 location-based, or Scope 2 market-based emissions, and
- Verified to a reasonable level of assurance.

Table 3. Total Entity Emissions by Emission Type Under Operational Control

Emissions Verified	2016 CO ₂ e (metric tons)
Scope 1 Total	8,777.90
Scope 1 Biogenic Total	116.18
Scope 2 Location-Based Total	11,016.33
Scope 2 Market-Based Total	11,016.33

*Individual categories may not sum to total due to rounding

Lead Verifier Signature



Nina Pinette

Independent Peer Reviewer Signature



Jessica Stavole-Carter